



Case Report

Destabilization and intracranial fragmentation of a full metal jacket bullet

A. Farrugia MD (Medical Examiner)*, J.S. Raul MD PhD (Assistant Professor),

A. Geraut MD (Medical Examiner), M.C. Tortel MD (Anatomopathologist),

B. Ludes MD PhD (Director, Professor)

Institute of Forensic Medicine, Strasbourg University Hospital, 11 rue Humann, 67085 Strasbourg Cedex, France

ARTICLE INFO

Article history:

Received 8 February 2008

Accepted 15 January 2009

Available online 18 February 2009

Keywords:

Forensic science

Bullet fragmentation

Destabilized bullet

Ballistic

ABSTRACT

We report a case with an atypical entrance wound as a result of a destabilized full metal jacket bullet penetration. The destabilized bullet by an impact with the dorsal hand experiences a yawing to tumbling motion in flight. The large angle of yaw induces a larger presenting profile upon impact that contributes, associated to a rapid deceleration, to a greater mechanical force on the projectile structure and a fragmentation into core and jacket. Forensic pathologists have to be aware that the metal jacket bullet could tend to break up outside or inside the body particularly after a shooting through a target. This phenomenon induces atypical entrance wounds and atypical X-ray presentation.

© 2009 Elsevier Ltd and Faculty of Forensic and Legal Medicine. All rights reserved.

1. Introduction

According to their composition, the projectiles can be classified into two categories: the homogeneous projectiles made of only one material, such as naked lead (0.22 Long Rifle), and the projectiles made of a core and a jacket (7.65 mm Browning). The tendency for bullet deformation and fragmentation is an intended feature of the bullet by virtue of its physical makeup and the bullet is fashioned for this effect by the manufacturers of ammunition.⁶ Normally, the total and full metal jackets were fashioned not to fragment.⁴ However, certain types of full metal jacket rifle bullets are designed to fragment extensively. Moreover, the bullet's destabilization in flight by intermediary obstacles can induce a fragmentation of the projectile. We report this case to illustrate this possible phenomenon and to highlight the use of radiography and histopathology for establishing the bullet trajectory.

2. Case report

A 28-year-old woman was shot twice by her husband in the street. She was transported to the nearest Hospital where she died. External examination of the victim revealed in the right temporal region, a 7 mm × 6 mm oval entrance wound, surrounded by a symmetrical margin of abraded skin (Fig. 1). There were no soot, gunpowder residue or stippling around the wound.

On the back side of the right hand, we described a 10 mm × 5 mm blackish parchment-like abrasion surrounded by an 40 mm × 30 mm ecchymotic area (Fig. 2).

2.1. Radiological findings

The radiosopic examination of the body showed two metallic objects of different radiodensity projected on the left frontal area (Fig. 3). Furthermore, a fracture of the calvarium was also present. No fracture of the right hand was identified.

2.2. Autopsy findings

A 13 mm × 8 mm defect was found in the right parietal bone with internal beveling. This bone entrance wound was in the shape of a warhead (Fig. 4).

Brain examination revealed subdural and subarachnoid hemorrhage over both cerebral hemispheres, a bilateral intraventricular hemorrhage and a disrupted brain parenchyma.

We recovered in the left frontal lobe two fragments corresponding to the core (radiodense metallic object in X-ray) and the metal jacket (more radiolucent) of the projectile (Fig. 3).

2.3. Pathological findings

Pathological examination revealed that the skin lesion on the back side of the right hand presented the characteristics of an entrance contact wound with blackish deposit, a loss of tissue at derm level with homogenization of the derm, an haemorrhagic suffusion separated by polymorphonuclear leukocytes (Fig. 5).

* Corresponding author. Tel.: +33 390 243363; fax: +33 390 243362.

E-mail address: audreyfar2000@yahoo.fr (A. Farrugia).



Fig. 1. Oval contact entrance wound with a peripheral margin of abraded skin to the right temporo-parietal area.



Fig. 2. Black abrasion within an ecchymotic area corresponding of a bullet's impact during flight.

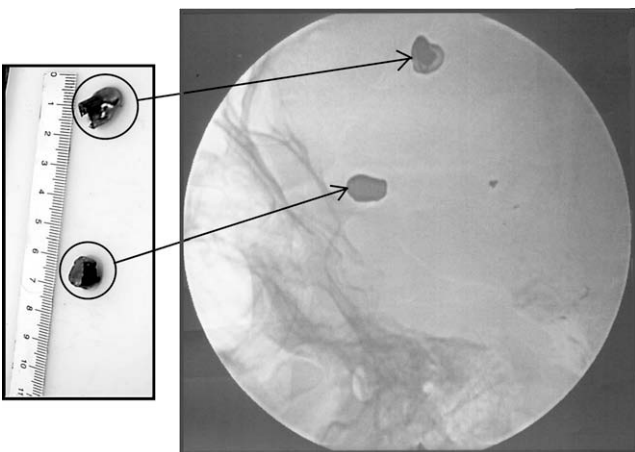


Fig. 3. X-ray showing two foreign bodies corresponding to the core and the jacket of the projectile.

These elements confirmed that the bullet's first impact was on the dorsal right hand surface.

The concerned weapon was a semi-automatic pistol with 7.65 mm full metal jacket cartridge.

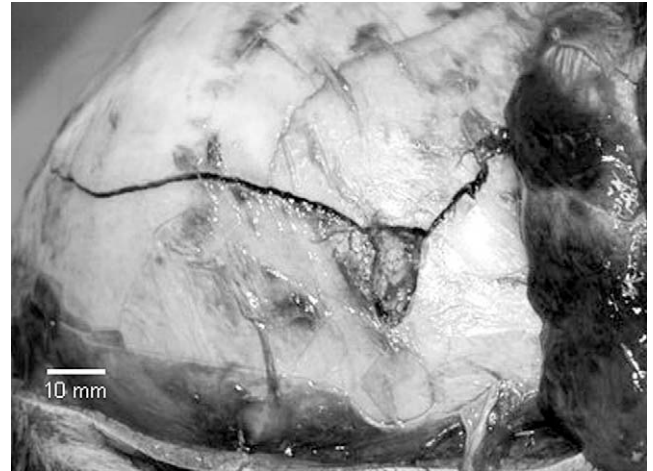


Fig. 4. Lateral view of the skull with an atypical entrance wound in the right parietal bone with multiple spreading fractures.

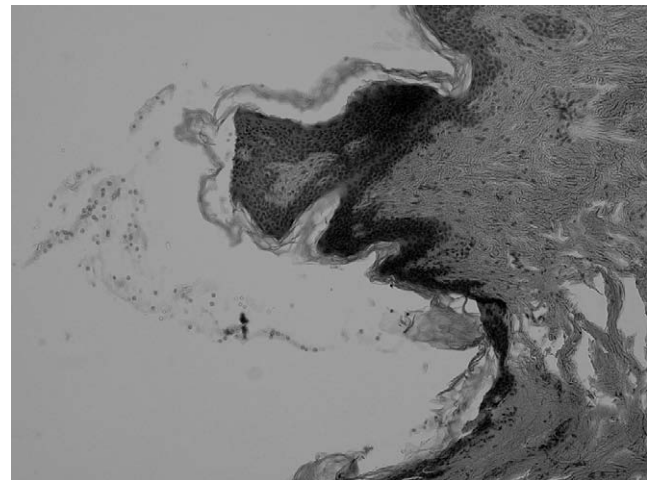


Fig. 5. Photomicrograph of the skin lesion of the back side of the right hand showing blackish deposit, homogenization of the derm and haemorrhagic suffusions (H&E X200).

The shooting distance between the weapon and right hand was approximately established between 0.5 and 1 m during the scene examination.

3. Discussion

Intermediary targets can modify the appearance of an entrance wound. When the bullet is destabilized in flight, the yaw phenomenon is more important and a large angle of yaw will affect the presenting profile upon impact and will contribute to create irregular and atypical entrance wounds.^{1,2,8,9} Intermediary targets include doors, windows, vehicle parts, body parts especially upper members and any other object that is interposed between the muzzle of the firearm and the skin.^{1,3,8}

The phenomenon of destabilization and fragmentation of a bullet after shooting through an intermediate target may induce atypical entry wound. Dixon² described the fragmentation after shooting through a tempered plate glass of vehicle door of a jacket hollow-point (Luger 9 mm) which produced a large entrance wound and small satellite wounds all around corresponding to the impact of the bullet fragments. The same phenomenon is

described by Thali et al.⁹ in a case in which the bullet of a 44 Remington Magnum created an atypical entrance after shooting through a finger.

Bullets destabilized by ricochet or as a result of an impact with some intervening object experience a yawing to tumbling motion in flight. As a result, they often produce atypical entry wounds as described in this case study, but also normal-appearing entry wounds. A destabilized bullet will either strike the victim with a yawed orientation (producing an atypical entry wound) or will enter sufficiently close to nose-forward during the in-flight yawing cycle that a normal-appearing entry wound results.⁵

The tendency of a bullet to break up depends on the mass, shape, physical structure of the projectile as the existence of a jacket, the type of jacket, or the existence of a hollow point.

For example, the 0.22 LR tends to cause severe wounds due to its velocity and tendency, due to yaw, to break up from the base, extruding and dispersing its lead core.^{6,7}

In our case study, bullet destabilized as the result of an impact with the dorsal hand experienced a yawing to tumbling motion in flight. The large angle of yaw induced a higher presenting profile upon impact with the cranium that contributed, with a rapid deceleration, to induce a greater mechanical force on the projectile structure and its fragmentation in core and jacket.

4. Conclusions

Forensic pathologists have to be aware that the metal jacket bullet could tend to break up outside or inside the body especially after a shooting through an intermediate target. This phenomenon induces atypical entrance wounds and atypical X-rays. The radiography should be obtained on all gunshot wound cases especially in case of fragmentation to localize the different fragments of the projectile. Indeed, X-rays demonstrate the number and location of the projectile fragments with the rifling. This case underlines the inter-

est of pathological examination which allowed to construct different hypothesis and to deduce the possible trajectory of the projectile.

Conflict of interest

None declared.

Funding

No funding.

Ethical approval

No ethical approval is needed as it is a short report.

References

1. Di Maio VJM. *Gunshot wounds*. 2nd ed. Boca Raton, New York: CRC Press; 1999.
2. Dixon DS. Tempered plate glass as an intermediate target and its effects on gunshot wound characteristics. *J Forensic Sci* 1982;**27**:205–8.
3. Dolinak D, Matshes EW, Lew EO. *Forensic pathology: principles and practice*. Elsevier Academic Press; 2005.
4. Gallusser A, Bonfanti M, Schütz F. Expertise des armes à feu et des éléments de munitions dans l'investigation criminelle. Presses polytechniques et universitaires romandes; 2002.
5. Lucien C, Haag BS. Wound production by ricocheted and destabilized bullets. *Am J Forensic Med Pathol* 2007;**28**:4–12.
6. Naldoo SR. Ballistic trauma, overview and statics in encyclopedia of forensic and legal medicine, vol. 1. Elsevier Academic Press; 2005.
7. Nordstrand I, Janzon B, Rybeck B. Break-up behavior of some small caliber projectiles when penetrating a dense medium. *Acta Chir Scand* 1979;**489**:81–90.
8. Stone IC, Petty CS. Interpretation of unusual wounds caused by firearms. *J Forensic Sci* 1991;**36**:736–40.
9. Thali MJ, Kneubuehl BP, Dirnhorfer R, Zollinger U. Body models forensic ballistics: reconstruction of a gunshot injury to the chest by bullet fragmentation after shooting through a finger. *Forensic Sci Int* 2001;**123**:54–7.